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USSR Report

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No. 57



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19 February 1980

**USSR REPORT
ELECTRONICS AND ELECTRICAL ENGINEERING
No. 57**

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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Certain Aspects of Computer Hard and Soft Ware;
Control, Automation, Telemechanics and Machine Planning

USSR

THE CAMAC SERIAL HIGHWAY (A SURVEY)

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 7-31
manuscript received 2 Jun 78

FOTEYEV, V. A.

[Abstract] The paper is a review of developments in the CAMAC serial highway interface since its inception in 1972, and an assessment of the current state of the serial highway. The presentation assumes some familiarity of the reader with the CAMAC system. The author covers the most important aspects of organization of the serial highway, describes the various models of drivers, passive and programmable controlled devices, loop control modules and other components of the interface, and discusses applications of the CAMAC serial highway in physics experiments and in industry. Software is described including "Driver" systems programs and user applied programs. It is expected that the CAMAC serial highway will be extensively used in nuclear physics experiments in the near future. Figures 17; tables 8; references 89: 14 Russian, 75 Western.

[71-6610]

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CSO: 1860

USSR

UDC 621.398.69

AN EXPANDER ATTACHMENT FOR A NARROW-BAND TELEMETRY SYSTEM

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 236-
237 manuscript received 10 Apr 78

BRASLETOV, V. A.

[Abstract] The paper describes an attachment that is installed at the input of a narrow-band telemetry system to increase the frequency spectrum. The device converts the data from each channel to pulse-amplitude code with a pulse utilization factor equal to unity. The unit serves n parallel channels with n switches and n memory elements controlled by a common commutating unit. When a commutating pulse arrives at a given switch, the switch

remains closed for the time of the pulse, and the voltage appearing at that instant at the output of the telemetry sensor is recorded in the memory unit. When the pulse is terminated, the switch opens, and the memory unit stores the given voltage value. Just before the next pulse arrives at the input of the same switch, the stored voltage value is read out. A block diagram and schematic circuit are given. Tests on a typical multichannel telemetry system showed that the attachment can expand the frequency band in telemetry by a factor of 1000 with simultaneous suppression of the mutual influence of parallel channels. Figures 3.

[71-6610]

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CSO: 1860

USSR UDC 681.327.67:681.325

A DEVICE FOR SAMPLING AND STORAGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 116-118 manuscript received 10 May 78

DUBITSKIY, L. A. and OSIPOV, V. N., L'vov Polytechnical Institute

[Abstract] A sampling and storage device previously proposed by these authors [see "Pribory i tekhnika eksperimenta," No 1, 1978, p 67] has the disadvantage of low speed due to an additional correcting capacitor connected to the main amplifier output in the sampling mode. The dynamic properties of the device are also impaired by the adverse action of the switch that connects the storage capacitor to the main amplifier output. In this paper the authors propose an improved sampling and storage device in which the main amplifier has a differential input and two identical outputs with equal voltage gain. In the proposed circuit the correcting and storage capacitors are charged separately, which eliminates the deficiencies of the former device without impairing the properties of the circuit in the static mode. The device is used in a 12-digit analog-digital converter of instantaneous voltage values. The static error is 0.05 percent over a temperature range of 0-45°C for input signals in a range of ± 5 V. Sampling time is 2 μ s, and aperture time is <15 ns. Maximum rate of change of a signal in the sampling mode is 8 V/ μ s, and the rate of discharge of the storage capacitor in the storage mode is 0.2 V/s. Figures 2; references 3 (Russian).
[71-6610]

6610
CSO: 1860

Communications, Communication Equipment, Networks,
Data Transmission and Processing

USSR

ARKA EQUIPMENT: HOW TO ACHIEVE EFFICIENT AND RELIABLE OPERATION

Moscow VESTNIK SVYAZI in Russian No 12, 1979 pp 13-14

KOZIN, A. M., senior engineer, radio bureau, Yakutsk Radio Center

[Abstract] New radiotelephone equipment is first tested using an Arka-Arka test hookup. After it has been properly adjusted, the radiotelephones are ready for test operation in the radio channel. Noises and transient interference have led to transmission and reception problems. The selective signal shaping circuits in some transmission drivers had to be tested and the amplitude-frequency response in the quartz oscillators had to be corrected. Particular attention was focused on the portion of the response curve which is related to operation of low frequency signals in the 2700-3000 Hz range; with good amplitude-frequency response (± 1 dB) the transmitter operates optimally. If the communications are stable, the display monitor arrow should be in the green range when the selector is in the "Reception Control Monitor" position. If there is a breakdown in channel, even though the arrow remains in the green, the monitor should move the switch to the "Expander Control Monitor" position. If the display arrow is deflected 50 or more percent, the receiver or transmitter is generally detuned on the minus side by more than 10 Hz. The nominal signal level can not be exceeded by more than 4 dB, because the line input automatic signal level regulators. Operation of the ARKA equipment requires technical training; the results of prototype operation were used to compile a training course. The use of Arka equipment distinguishes the radiotelephone channel from current ones. Figures 1.

[115-8617]

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CSO: 1860

USSR

MEANS OF IMPROVING PLANNING ESTIMATES

Moscow VESTNIK SVYAZI in Russian No 12, 1979 pp 17-18

VINOGRADOV, P. N., deputy chief, Glavsvyaz'proyekt (Main Administration for Planning Communication Facilities)

[Abstract] An important condition for ensuring the quality of planning estimates based on new drafts of scientific-research institutes, design offices and the experience of construction and operating organizations. Attention must be given to standardization of planning decisions and their unification. Maximum unification and standardization of planning decisions positively affects the quality of plans, because they reduce the probability of errors. The Giprosvyaz' (State Institute for Investigation and Planning of Communication Construction) and Giprosvyaz-2 institutes have drafted standardized planning decisions for the technological portion in terms of separate kinds of structures. Unification of nonstandardized articles has been done over the past 3 years. Consequently, the products list of nonstandardized items was shortened by 10-15 percent. Internal appraisal and consideration of plans in technical councils with the participation of experts of the appropriate background of other institutes and Glavsvyaz'proyekt has a positive effect on the quality of PSD. A finalizing step in determining the quality of PSD is external appraisal. The set of all measures taken by Glavsvyaz'proyekt and planning institutions raised the 1978 quality of planning by three percent over 1977 (78 percent of plans of those examined received good and excellent evaluations).

[115-8617]

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USSR

AUTOMATION OF RADIO AND TELEVISION TRANSMITTING STATIONS

Moscow VESTNIK SVYAZI in Russian No 12, 1979 pp 25-27

SHCHERBICH, A. V., chief engineer, Minsk RTPTs [Radio and Television Transmitting Center]; SHISHLO, V. N., chief of RTPTs; KHAZANOV, A. SH., candidate in technical sciences, head designer of NIIR (Scientific-Research Institute of Radio); KORABCHIKOV, V. D., chief, Zonal Laboratory of RURT [Republic Unit for Broadcasting, Radio Communication and Television] of the Ministry of Communications of Belorussian SSR; and PASHKOVSKIY, I. YU., senior laboratory engineer

[Abstract] The problem of centralized control and monitoring of multichannel radio and television transmitting stations at which television and radio broadcasting transmitters are established is related to the increased number of these stations, the need to order control and monitoring, and to enhance the efficiency and labor productivity of the staff. The system developed jointly by the Minsk RTPTs and the Scientific-Research Institute of Radio (NIIR) places the control monitor in the direct proximity of the transmitters in the same building, because most stations can not operate without constant manning. The introduction of the system in multichannel radio and television transmission stations will raise monitoring objectivity, order monitoring and control of radio transmitters and reduce the size of monitoring and measuring equipment, and also enhance efficiency and labor productivity of maintenance personnel. Figures 3.

[115-8617]

8617

CSO: 1860

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ENHANCING THE OPERATING QUALITY OF RADIO AND TELEVISION TRANSMITTING STATIONS

Moscow VESTNIK SVYAZI in Russian No 12, 1979 p 39

DALADA, N. F.

[Abstract] In the second issue of "Vestnik svyazi" for 1979, T. I. Bartkus, chief engineer of the Lithuanian Republic Radio and Television Transmitting Center published an article entitled "Efficiency and quality of production of radio and television transmitting stations" in which he named the factors hindering the enhancement of quality and labor productivity of workers of radio and television transmitting stations. Reader response was encouraged by the journal, and some of the comments received follow below. V. A. Sidorenko, head of the Ukrainian Republic Radio Broadcasting Center, states that manufacturers of equipment do not pay enough attention to reliability and quality of their products. Workers of the Sakhalin Radio and TV Transmission Center report that RTsTA and RPTN retransmitters are delivered with gross manufacturing defects. Workers of the Tomsk Radio and TV Transmission Center say that they have individual booths, but no standardized control panels in them. Coworkers of the Georgian Republic Radio and TV Center feel that the design of RTPTs (Radio and Television Transmitting Center) panels, mass production of measuring demodulators, and expanded production of test stands will improve quality of transmitting stations. Yakutsk communications workers propose standards for full operating time and deviations from the norm for each type of transmitter. Judging by the response to Bartkus's article, measures are now being taken to eliminate the deficiencies mentioned above. Yu. M. Fomin, deputy director of the Technical Administration of the USSR Ministry of Communication states that on-going development work on ATRS-50/5, 11'men'-2 and the mass-produced ATRS-5/1, 11'men' and Zona-2 TV transmitters meet today's increased requirements. The old Yakor', Igla, Uragan and Len transmitters are being updated.

[115-8617]

8617

CSO: 1860

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TUNING OUTPUT LOOP SYSTEMS OF TELEVISION RADIO STATIONS

Moscow VESTNIK SVYAZI in Russian No 12, 1979 pp 19-20

LOKSHIN, A. M., candidate in technical sciences, and KOL'TSOV, A. A., co-workers of Scientific-Research Institute of Radio; and AROL', I. I., senior engineer of RRTPTs [expansion unknown] of the Estonian SSR Ministry of Communications

[Abstract] Output stages which operate in the TV network of radio stations are composed of two units whose output is combined in a bridge circuit. The amplitude-frequency response of each unit must have irregularity of the plane portion $M \pm 0.5$ dB, slope transconductance of $S 40$ dB/MHz. Loop systems of the units are usually tuned using a sideband analyzer, but problems arise in optimum tuning of amplitude-frequency response of each unit because of the coupling of output systems of both units across the adding bridge. But the loop systems of both units can be tuned without reciprocal coupling by using the XI-19 device connected across a junction device. At the output of each unit, amplitude-frequency response within the channel band must be almost horizontal. Some irregularity is the result of the quadrature adding circuit and has virtually no effect on the net output response. The method of tuning loop systems is extremely efficient. Figures 9.

[115-8617]

8617

CSO: 1860

OSCILLATOR FREQUENCY CHECKING SYSTEM

Moscow VESTNIK SVYAZI in Russian No 12, 1979 p 21

POPOVA, N. E., candidate in technical sciences, Department Head Central Scientific-Research Institute of Communications and MALINKINA, T. N., engineer

[Abstract] The stability of carrier frequencies in transmission systems using frequency channel separation depends on the stability of the frequency of master oscillators (ZG) over time. From time to time ZG frequency is compared with signals of reference frequency and is retuned. Reference frequency signals transmitted through long-wave and medium-wave radio stations are the most convenient for comparison, and are stable and reliable. Adequate

emission field strength in the area of the communications enterprise is required for reception of these reference frequencies: a special receiver of the PTCh-66 type was developed for the reference frequency 66.6 kHz. The linear 308 kHz frequency corrector was adopted to compare ZG frequencies of operational coaxial cable and radio-relay line transmission systems (K-1920, K-1920U, RRL-600, VLT-1920, K-300) and 60-channel detection group equipment; the 16 kHz frequency corrector was chosen for balanced cable K-60 transmission systems and 12-channel detection group equipment. Frequency comparison in K-1920 equipment with the linear 308 kHz frequency corrector is accomplished by tuning the ZG of each subsequent station to the ZG of the preceding station. It is possible that power supplies at ZG frequency may be used to improve the system of comparison and maintenance of master oscillator frequency.

[115-8617]

8617

CSO: 1960

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UDC 621.391.14

SHIFTED DISCRETE FOURIER TRANSFORMATIONS

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15 No 4, Oct/Dec 79
pp 102-105 manuscript received 9 Nov 77; after revision 5 Jun 78

YAROSLAVSKIY, L. P.

[Abstract] Elimination of the nonessential constant exponential factors from the discrete Fourier transformation and the inverse discrete Fourier transformation yields correspondingly a shifted discrete Fourier transformation and an inverse shifted discrete Fourier transformation, which really represent a "rotation" of vectors of the series and its spectrum so that the algorithms of the fast Fourier transformation become applicable here. Three properties of these transformations are of interest in digital data processing. A shifted discrete Fourier transformation $(1/2, 0)$ of two signals simultaneously and thus a convolution of two signals during their even continuation is possible, by virtue of the first property, so that end effects of cyclic convolution can be avoided. Interpolation of signals is possible with the pair of shifted discrete Fourier transformation (u, v) and inverse shifted discrete Fourier transformation (p, q) properly matched, by virtue of the second property, also evaluation of the spectrum with an arbitrary distribution of readings. Interpolation of convoluted signals or their

cross-correlation function is possible, analogously, by virtue of the third property. References 6 (Western).
[111-2415]

2415
CSO: 1860

USSR

UDC 621.391.15

SEQUENTIAL DECODING FOR CHANNELS WITH SYNCHRONIZATION ERRORS

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15 No 4, Oct/Dec 79 pp 12-16 manuscript received 11 Jul 78

ZICANGIROV, K. SH.

[Abstract] A model of signal transmission is considered which includes not only additive noise in the communication channel but also possible desynchronization between receiver and transmitter, the latter consisting of an encoder and a modulator. A basic 5-step procedure of sequential decoding in the receiver is described and the corresponding channel performance characteristics (Gallagher function, capacity, speed and reliability function) are given. References 4: 2 Russian, 2 Western.
[111-2415]

2415
CSO: 1860

USSR

UDC 621.391.63

TRANSMISSION CAPACITY OF A QUANTUM COMMUNICATION CHANNEL

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15 No 4, Oct/Dec 79
pp 3-11 manuscript received 23 Feb 78

KHOLEVO, A. S.

[Abstract] The simplest mathematical model of a quantum communication channel is considered where a quantum state corresponds to each letter of the input alphabet in a fixed finite-dimensional unitary space. Its capacity is defined as $C = \lim_{n \rightarrow \infty} C_n / n$, on the basis of a coding theorem which follows from the classical information theory, and the correctness of this definition is demonstrated by estimates of the error probability. The method of random codes is found to be expedient here. A binary channel, generally in a two-dimensional complex space, is considered as a specific example and its capacity is estimated accordingly. Figures 1; references 10: 7 Russian, 3 Western.

[111-2415]

2415

CSO: 1860

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UDC 621.391.63

OPTIMAL PROCESSING OF AN OPTICAL SIGNAL DISTORTED BY A RANDOMLY NONHOMOGENEOUS MEDIUM

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15 No 4, Oct/Dec 79
pp 106-110 manuscript received 24 Feb 78

ALEKSANDROV, A. B., BAKUT, P. A. and LOGINOV, V. A.

[Abstract] Under consideration are regular optical signals coming from a point source and arriving at the aperture of a receiver mixed with normal white noise and a random interference. The latter is due to fluctuations of the refractive index of the medium through which the signals propagate and is, in the case of short-duration signals, independent of time. The likelihood ratio, which can serve as the basis of an optimal detection algorithm, is calculated here first for a weak signal by the method of local optimality and then for a strong signal by the asymptotic method according to Laplace. References 7 Russian. One a translation of a Western book.
[111-2415]

2415

CSO: 1860

USSR

UDC 621.391.82

STUDY OF THE EFFECT OF SIMILAR INTERFERENCE ON THE DYNAMICS OF PSEUDORANDOM SIGNAL SYNCHRONIZATION SYSTEMS

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 969-978 submitted 12 Jun 78

PONOMARENKO, V. P. and KIVELEVA, K. G., Scientific-Research Institute of Applied Mathematics and Cybernetics, attached to Gorky University

[Abstract] Transmitted signal spectra are expanded in modern communications systems to measure motion efficiently, protect against interference and enhance operating secrecy. Pseudorandom signal modulation is often used to shape an expanded-spectrum signal. Rough synchronization is accomplished by time delay retrieval. Precision synchronization and tracking are accomplished by delay tracking systems. The results obtained in the paper suggest that disturbance of stability is related to passage of error beyond the limits of the discrimination characteristics or with a shift to interference tracking. Figures 5; references 11: 8 Russian, 3 Western.
[42-8617]

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CSO: 1860

USSR

UDC 621.394.74

ONE CLASS OF A STAR NETWORKS WITH COMMUNICATION BY PACKET SWITCHING

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15 No 4, Oct/Dec 79 pp 53-72 manuscript received 4 Sep 78

KEL'BERT, M. YA. and SUKHOV, YU. M.

[Abstract] A star network is considered with a structure consisting of a central station and N "peripheral" correspondent information sources, each connected to the central station by two lines for 2-way communication. An analysis on the basis of one convergence theorem and two limit theorems, all proved here, shows that for a sufficiently large number N the mathematical expectation of the message travel time is much shorter with packet switching than with message switching. When $N \rightarrow \infty$, furthermore, the message waiting times in any of the information sources and in the central station become

asymptotically independent random quantities. With packet switching, moreover, the waiting time for the first packet of a separate message does not exceed the mean waiting time in a simple queue. Also the message "transduction" time in the central station then becomes shorter. In a more general case the central station also becomes an information source, an appropriate third limit theorem being applicable to this situation. In the case of a star network with packet switching, the lower estimate is established here for the mean message delivery time when the message has been subdivided into packets of standard length. The impetus for this study was provided by S. A. Chekulayev. The authors also thank R. L. Dobrushin and A. Ya. Tolchan for interest in this study and helpful comments. Figures 1; references 7: 6 Russian, 1 Western.

[111-2415]

2415

CSO: 1860

HOLD TO DETERMINE THE SITE OF REDUCED INSULATION RESISTANCE BETWEFN CABLE STRANDS

Moscow VESTNIK SVYAZI in Russian No 12, 1979 pp 29-30

KAMRAZ, E. V., chief, Department of Operation of Cable Mainlines, Central Junction of Communications and Radionavigation, Ministry of the River Fleet, RSFSR

[Abstract] Cables usually have to be cut open and additionally measured in order to determine the site of damaged insulation between cable strands located between couplings. Experience has shown that reduced insulation resistance between individual strands is the result of intense pinching and twisting of the cable sheath; the cable is subjected to deformation and destruction at such points, and the insulation resistance between strands can drop 'n several dozen megohms or less, or even produce short circuits. When cables are tested with high voltage, as is done in intercity lines, a spark can jump between damaged points and so-called insulation breakdown occurs. The WM and IP-64 devices make it possible to find a breakdown site without cutting open the cable. Figures 1; tables 2.

[115-8617]

8617

CSO: 1860

**Components and Circuit Elements Including
Filters, Waveguides and Cavity Resonators**

USSR

UDC 621.3.072.7

A PULSE PHASE SHIFTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 141-144 manuscript received 19 Apr 76, after revision 26 Dec 78

ZAMETIN, V. I. and PUTILIN, A. N., Rostov State University

[Abstract] Among the deficiencies of conventional phase shifters with active and passive RC circuits are: 1) A narrow working frequency range; 2) Operation restricted to sine waves; 3) Nonlinearity of phase setting; and 4) Change in phase shift with a change in frequency. The authors describe a voltage-controlled or current-controlled pulse phase shifter that has none of these limitations. The device is designed for controlling the switches of synchronous detectors and filters, and is used in a synchronous amplifier of a modulation spectrometer. The phase-setting error is $\pm 4^\circ$ in a band from 20 Hz to 30 kHz. The phase shift is linearly dependent on the controlling parameter. The range of continuous change in phase angle is from 0 to $\pm 150^\circ$. The output signal of the phase shifter is made up of two trains of square pulses in opposed phase with an amplitude of 0 - +10 V, and rise and fall time of 200 ns. The duty factor of the output pulses is automatically set equal to that of the reference voltage, thus optimizing the match between the spectrum of the signal being measured and the transfer function of the synchronous detector or filter. Figures 2; references 5: 4 Russian, 1 Western.

[71-6610]

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CSO: 1860

USSR

UDC 621.316.722

A COMPENSATED SUBMILLIAMPERE CURRENT SOURCE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 160-162 manuscript received 24 Mar 78

ZHELUDKOV, N. I., KAREYEV, V. A. and MEYER, V. V., Ryazan Radio Engineering Institute

[Abstract] Reference current sources are frequently required that draw less than 1 mA. Semiconductor stabilitrions are not suitable for use in such sources because of poor temperature stability. A source proposed by J. L. Turino uses a field-effect transistor with a bias resistor in the source circuit [see "Electronic Design," Vol 21, No 2, 1973 p 66]. This circuit achieves stability by eliminating sensitivity to fluctuations in temperature and supply voltage. The output current of the source is limited to the immediate vicinity of the thermostable point. As a result of an investigation of thermal instability of the drain current of the FET in the vicinity of biases across the gate, the authors have developed a submilliampere compensated current source in which the output current is made independent of the variation in supply voltage and load impedance by cascode connection of the FETs in each arm of the oscillator. The source produces direct current in a range of 0.01-500 μ A. Output impedance is at least 25 megohms and temperature instability is no more than $5 \cdot 10^{-7}^{\circ}\text{C}^{-1}$ in a range of 0-100°C. Figures 2; references 4: 3 Russian, 1 Western.

[71-6610]

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CSO: 1860

USSR

UDC 621.317

A METHOD OF MEASURING THE NOISE CHARACTERISTICS OF ANALOG COMMUTATORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 p. 118-120 manuscript received 20 Mar 78

DOROSH, A. G., MOKRITSKIY, V. A. and SIGUNOV, YU. B., All-Union Scientific Research Institute of the Metrology of Measurement and Control Systems, L'vov

[Abstract] A method is proposed for measuring the noise characteristics of an analog commutator in static states: the spectral density of noise voltage of the opened switch, and the spectral density of noise current of the closed switch. Block diagrams of the measuring arrangements are given. Measured noise characteristics are given for K1KT682B commutators in the frequency range from 2 Hz to 20 kHz. The proposed technique can be applied to any low-noise electronic components, both low-resistance and high-resistance.

Figures 3.

[71-6610]

6610

CSO: 1860

USSR

UDC 621.372.4

ALGORITHM FOR NUMERICAL ANALYSIS OF A STRIP RESONATOR

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 1028-1031 submitted 15 Sep 78

NIKOL'SKIY, V. V. and PUGACHEVA, T. V., Moscow Institute of Radio Technology, Electronics and Automation

[Abstract] Strip resonators made in the form of plane metallic elements which are applied on a dielectric substrate (which is screened on the reverse side) are of interest in the design of microwave integrated circuits. A convenient method for analyzing strip resonators is a numerical study based on integral impedance or admittance type equations. A planning algorithm is developed for an impedance-type integral equation which simulates a screened strip resonator. The algorithm is efficient and is internally consistent. The resonance length of the open strip is shorter than the half-wave segment of a regular line; however, at higher frequencies where the boundary effect

is inductive and not capacitive, the resonator may be elongated. There is a rapid reduction in the screen effect as it is expanded. Figures 4; references 2 (Russian).

[42-8617]

8617

CSO: 1860

USSR

UDC 621.374(031)

NANOSECOND HIGH-CURRENT AND HIGH-FREQUENCY SWITCHES BASED ON METAL-DIELECTRIC-SEMICONDUCTOR POWER TRANSISTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 134-136 manuscript received 24 Apr 78

BACHURIN, V. V. and D'YAKONOV, V. P., Smolensk Affiliate of Moscow Power Engineering Institute

[Abstract] The authors discuss the merits of series produced microwave MDS power transistors (KP901, KP902, KP904, KP905) as devices for producing powerful pulses with a recurrence rate up to hundreds of megahertz. The advantages of these devices include high working currents, voltages and average powers, absence of excess charge accumulation in the active region, transconductances reaching 4.5×10^5 microhms, lower input and output capacitances than bipolar transistors of the same power, no limitations on pulse applications, no influence of gate voltage and frequency on the maximum permissible voltage, high temperature stability and high input impedance. Switches based on these FETs are described with a switching time of 1 ns that handle currents up to 2-3 A. These switches have very short turn-on and turn-off times, enabling switching recurrence rates of up to tens and hundreds of megahertz. The switches can be triggered by pulse circuits based on low-power avalanche transistors. Figures 3; references 4 (Russian).

[71-6610]

6610

CSO: 1860

Cryogenics and Superconductivity

USSR

UDC 537.312.62+621.316.9

A DEVICE FOR PROTECTING SUPERCONDUCTIVE MAGNETS WITH A SUPERCONDUCTIVE CROSSPIECE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 198-200 manuscript received 26 Jun 78

KABAT, D., LYUDEMANN, R., MENKE, KH. and SHISHOV, YU. A., Joint Institute of Nuclear Research, Dubna

[Abstract] The authors consider the requirements that must be met by reliable emergency protection devices for superconducting magnets in the frozen-current mode. Such a device must ensure evacuation of the energy stored in the magnet both during input and output of current, and also in the frozen-current state. The greatest danger of reversion to the normal state occurs during current input. To ensure a high ratio of the fraction of energy released in the protective load to the energy stored in the magnet, the superconducting bridge must be replaced or supplemented with a superconducting cutoff that has fairly high resistance in the normal state and can be rapidly controlled. The circuit must also be designed so that the power supply to the magnet does not interfere with energy evacuation. The paper describes a device that meets these requirements developed by the Cryogenic Department of the Joint Institute of Nuclear Research. In experiments with a solenoid with induction in the center of 8 T at a current of 150 A and maximum stored energy of 50 kJ, the effectiveness of energy extraction was 60-80 percent in simulation of transition to the normal state, and about 40 percent in the case of disruption of superconductivity. Figures 3; references 3: 2 Russian, 1 Western.

[71-6610]

6610

CSO: 1860

Electrical Engineering Equipment and Machinery

USSR

UDC 621.313.8:62.71.001.4

CORROSION OF ELECTRICAL MACHINERY WATER COOLING SYSTEM COMPONENTS

Moscow ELEKTROTEKHNIKA in Russian No 12, 1979 pp 28-31 submitted 9 Oct 78

BALABANOV, I. G., engineer; PAL'MSKIY, V. G., candidate in chemical sciences
and MILYUTS, G. B., engineer

[Abstract] Increased unit output of electrical machinery with total or partial water cooling and assurance of long-term, reliable operation requires reliable data on the corrosion resistance of active and passive materials used to construct current conductors, water cooled components, water supply conduits and water preparation apparatus. Emergencies can arise when corrosion exceeds the nominal rate for the equipment because of factors such as clogging of hollow conduits due to hot spots or foreign objects, leakage, etc. The widely used ion-exchange resins must be carefully employed in order to avoid entry of resin into the coils. The system must be air-tight and insulated from the ambient air by an inert gas under excess pressure. Water pressure inside the machine must be kept higher than the saturated vapor pressure to prevent boiling. Optimum flow rate of water in the conduits is 1.0 meter per second, with a high of 1.5 meters/second and low of 0.8 meter/second. Optimum resistivity of the distillate is 1,000 kohm.centimeters. When passing through the water-cooled elements, the water should optimally rise 20°C. The pH (20°C) should lie between 8.5-9. Figures 3.

[116-8617]

8617

CSO: 1860

USSR

UDC 621.314.213.1.045.1.015.53.001.24

VOLTAGE OF FORMATION OF PARTIAL DISCHARGES IN THE LAYERED WINDINGS OF SF₆ TRANSFORMERS

Moscow ELEKTROTEKHNIKA in Russian No 12, 1979 pp 12-14

ARSON, A. G., candidate in technical sciences, and GOLOVACHEV, V. A., engineer

[Abstract] When designing SF₆ transformers, one of the main problems is the choice of the thickness of insulation between the winding layers, because high voltage (HV) and low voltage (LV) windings determine the electromagnetic characteristics of the transformer. A fundamental condition for selecting insulation thickness at working voltage is the complete absence of partial discharges in the insulation or their stringently analyzed level. At rated working pressure and voltage 10 percent over the working level, partial discharges were not recorded in a single transformer. Then V_{pd0} was measured under pressures from 0.7 to 1.4 megapascals. Theoretical V_{pd0} are in rather good agreement with test data obtained on actual transformers with different minimum thickness of interlayer insulation. The theoretical formula proposed can quite accurately evaluate the partial discharge voltage in layered windings of SF₆ transformers as a function of winding design, insulating material and technological treatment of the winding. Figures 1; references 4 (Russian).

[116-8617]

8617

CSO: 1860

USSR

UDC 621.314.222.6.048.2.019.34.001.24

CALCULATION OF CHARACTERISTICS OF INSULATION VULNERABILITY TO DAMAGE IN HIGH-VOLTAGE POWER TRANSFORMERS ACCORDING TO INSULATION SIMULATION TESTS

Moscow ELEKTROTEKHNIKA in Russian No 12, 1979 pp 2-4 submitted 10 May 79

LEVIT, A. G., candidate in technical sciences

[Abstract] Use of expressions based on the representation of a system (original) as a set of multiply repeated identical insulation elements (models) located in a system under identical conditions is generally inaccurate for determining the overall characteristics of insulation vulnerability to damage. This approach produces noticeable errors which are of particular significance when attempting to create an optimum design: in many industrial insulation systems the voltage loads vary from element to element, even in identical elements. Calculations performed for the inter-winding insulation of a power transformer based on the distribution of voltage along the winding can raise the theoretical values of intensity in this insulation as compared to the methods of Dokopoulos (1968); and consequently, improve the transformer's technical and economic indicators. Information on the dimensions of the active zone of the winding, i.e., the quantity and location of insulation elements, may be used since it essentially dictates the characteristics of its vulnerability to damage. Figures 4; references 5: 2 Russian, 3 Western.

[116-8617]

8617

CSO: 1860

UDC [669.14:658.562].004.1

METROLOGIC QUALITY CONTROL OF TRANSFORMER STEEL

Moscow ELEKTROTEKHNIKA in Russian No 12, 1979 pp 40-41 submitted 26 Apr 79

VDOVIN, YU. A., candidate in technical sciences and RYKOV, G. A., engineer

[Abstract] Some people think that quality control of transformer steel is the responsibility of the metallurgists who produce it, but this is not totally correct. The quality of the material depends, to a great extent, on the specific requirements of the user--the electrotechnical industry--which should perform quality control. The basic characteristics of transformer steel are spelled out in the effective technical specifications, but

it must be added that its product list is far from being optimum. Steel grade standards should indicate what kind of statistical characteristics are represented by the quality level indicator (batch average, maximally permissible value, etc.). Economic justification for metrologic requirements in transformer steel is a major problem in the sector. Electrotechnicians must analyze the cost component related to transformer steel quality and determine the economic criteria for selecting a level of control reliability. Recommendations can be made for improving the reciprocal calculation systems between the metallurgical and electrotechnical sectors of industry only on the basis of the cost of the required level of control reliability and the economic effect thereof.

[116-8617]

8617
CSO: 1860

**Electromagnetic Wave Propagation; Ionosphere;
Troposphere; Electrodynamics**

USSR

UDC 551.501.8

REMOTE WEATHER SENSING OF AN OVERCAST ATMOSPHERE BY RADIOMETRY

Corky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 938-945 submitted 12 Jul 78

KUZNETSOVA, M. G., RASSADOVSKIY, V. A. and TROITSKIY, A. V., Scientific-Research Radiophysics Institute

[Abstract] Remote weather sensing from the Earth's surface and above it has advanced--but most results are achieved in a cloud-free atmosphere. Cloud formations hinder measurements. Radiometry, however, rapidly and continuously determines the basic weather parameters: temperature and humidity profiles, integral moisture content, cloud water content, etc. Radiometry measures the direction and velocity of wind at the altitude of cloud cover. These measurements are based on the principle of "frozen" turbulence and correlation analysis of radioemission measurements of irregularities in integral water content using three geographically separated receivers. The authors thank V. I. Aleshin, A. P. Naumov and S. A. Zhevakin for discussion of the results obtained and a number of valuable comments. Figures 5; tables 1; references 11 (Russian).

[42-8617]

8617
CSO: 1860

Electron Tubes; Electrovacuum Technology

USSR

UDC 621.327.018.756:621.387

XENON AND ARGON VACUUM ULTRAVIOLET FLASH TUBES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 184-186 manuscript received 15 May 78

BASOV, YU. G., BOLDYREV, S. A., GAVRILOVA, L. I. DOYNIKOV, A. S. and TSVILYUK, G. YE.

[Abstract] Xenon and argon flash lamp designs are proposed in which the filtering properties of the quartz envelope are avoided by coupling the emission out through a lithium fluoride port that is protected from the discharge action by location at a distance of 20-80 mm. This extends the life of the lamps to several thousand flashes, and the LiF transmits wavelengths down to the vacuum ultraviolet range so that these devices can be used for studying photochemical reactions. Flash duration is in the microsecond range. The emission spectra show the considerable role of silicon atoms and strong absorption of shortwave emission by the quartz envelope. Integral radiation in the wavelength range of 140-250 nm is attenuated by the quartz walls of the lamp by a factor of more than 2. Figures 3; references 12: 10 Russian, 2 Western.

[71-6610]

6610

CSO: 1860

USSR

UDC 621.383.292

REGISTRATION OF WEAK LIGHT SIGNALS IN THE WAVELENGTH RANGE OF 1.0-1.2 μm

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 191-193 manuscript received 10 May 78, after revision 31 Oct 78

VODOP'YANOV, L. K., GOLUBEV, L. V., KOPANEV, V. D. and PLOTNICHENKO, V. G., Physics Institute, Academy of Sciences USSR, Moscow

[Abstract] The authors consider the use of the FEU-83 photomultiplier as a receiver in experiments on Raman light scattering with a YAG laser as the source. It is shown that cooling the photomultiplier to 77 K increases the threshold sensitivity and signal-to-noise ratio. Cooling is accomplished by blowing vaporizing nitrogen around the photomultiplier. The cooling

unit is described. The design provides uniform cooling and eliminates thermal stresses in the envelope of the photomultiplier tube. The proposed cooling technique enables continuous regulation of the photocathode temperature from 77 to 300 k. The enclosure of the cooling device is a double-walled evacuated quartz cup with a low-power heater to prevent condensation on the outer surface. Relative error is \leq 10 percent, and repeatability of results is within the limits of this error. Cooling improves the efficiency of registration of weak light signals in the 1.0-1.2 μm wavelength range. Figures 3; references 6: 4 Russian, 2 Western.
[71-6610]

6610

CSO: 1860

General Circuit Theory and Information

USSR

UDC 621.373

AN INTEGRAL-DIFFERENTIAL DISCRIMINATOR BASED ON MICROCIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 128-130 manuscript received 3 Apr 78

BUTSKIY, V. V. and VETOKHIN, S. S., Belorussian State University, Minsk

[Abstract] The paper describes a 100-channel integral-differential discriminator based on seven IC chips for handling signals of positive polarity with input amplitude range of 0.01-5 V. The discriminator includes a reference voltage stabilizer, a digital converter, a digital-analog converter, a circuit for setting the reference voltages, and a comparison device. In addition, the discriminator may also include a device for determining the signal maximum. A schematic of the discriminator is given and the operation is explained. Differential and integral nonlinearity is less than 1 percent. The unit can be used in a manual control mode (where the number of the channel is set by a programming switch) and in automatic control (where the levels of threshold voltages are varied by steps, i.e., with time-scanning of channels). The discriminator has been used for processing scintillation signals. Figures 1; references 4 (Russian).

[71-6610]

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CSO: 1860

USSR

UDC 621.374.335.2

A GATED INTEGRAL PULSE DISCRIMINATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 130-131 manuscript received 20 Mar 78; after revision 22 Sep 78

BALAMATOV, N. N. and PIL'SEN, YU. V., Scientific Research Institute of Nuclear Physics, Moscow State University

[Abstract] A discriminator circuit is proposed for pulses of both negative and positive polarities with minimum sensitivity threshold for pulses of both polarities of ~ 20 mV, and speed of ~ 40 MHz. The device can handle input pulses of up to 2 V. The discriminator is based on a 100UL1 microcircuit, and the output pulse is produced by a delay line and a K1LB383 microcircuit. Tests showed no change in the threshold characteristic with a

change in input signal duration from 20 to 200 ns on a frequency of 10 kHz. The discrimination threshold remains nearly constant with a change in trigger pulse frequency from 500 kHz to 20 MHz, and the change in threshold is no more than 10 percent at 40 MHz. Gating can be either pulsed or potential. Figures 2; references 3 (Russian).

[71-6610]

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CSO: 1860

USSR

UDC 681.327

A DEVICE FOR RECORDING TIME DISTRIBUTIONS OF COINCIDENCES IN MULTIPLE-DETECTOR SYSTEMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 125-128 manuscript received 26 Dec 77

KRASNOV, L. V. and YATSYSHIN, I. G., Leningrad State University

[Abstract] The paper describes a simple device used in conjunction with a time-amplitude converter or an oscilloscope for adjustment in order to eliminate time shifts between pulses in multiple-channel detector systems. This three-channel system can be easily expanded to a larger number of channels. The device has three inputs, "Start" and "Stop" outputs, and an output for connection to an oscilloscope. When an oscilloscope is used to study time displacements of pulses, the "Start" output is connected to the input of an external sweep trigger, and the "Oscilloscope" output is the signal output. The inputs of the device are connected to the outputs of the three channels being studied, and the signal coming to input 2 is the triggering signal used as a reference for the time shift of the signals in the other two channels. Operation of the device is based on cyclic sequential transmission of the pulses to the "Stop" output. The inputs are switched by a commutator made up of a ring counter, a decoder and a system of gates. A block diagram and schematic are given, and Results of measurements are discussed. Figures 3; references 2 (Russian).

[71-6610]

6610

CSO: 1860

Instruments and Measuring Devices and Testers;
Methods of Measuring

USSR

UDC 536.2.08.7

AN AUTOMATIC DEVICE WITH DIGITAL OUTPUT FOR DETERMINING THE COEFFICIENT OF LINEAR EXPANSION OF MATERIALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 p 269
manuscript received 21 Jan 78

FESENKO, A. I., BORISYUK, V. S. and MENCHEV, YU. P.

[Abstract] The device is designed for determining the coefficient of linear expansion of materials in the temperature range of 293-900 K. The device works in conjunction with a conjunction with a recording optical dilatometer that includes attachments for tracking the displacement of the ends of the specimen, a chronometer-frequency meter, and a digital printer. A chromel-alumel thermocouple with cold junction at 293 K is connected to the outputs of the device that records elongation of the investigated material. The unit operates on the principle of linear conversion of the emf of a differential thermocouple and the output voltage of the attachment to pulse recurrence rate. Specimen length can be set from 98 to 110 mm. The expansion measurement range is $\pm(0.3-500)10^{-6}$ K⁻¹. The device draws 50 W at 220 V. Measurements are 460 x 200 x 400 mm and weight is 6 kg. A photograph is shown of the exterior of the device. Figures 1.

[71-6610]

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CSO: 1860

USSR

UDC 536.24.08

AN AUTOMATIC DEVICE WITH DIGITAL OUTPUT FOR DETERMINING THE RATE OF CHANGE IN TEMPERATURE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 p 270
manuscript received 23 Jan 78

FESENKO, A. I., BORISYUK, V. S., GLINKIN, YE. I. and OSTROVSKIY, G. YE.

[Abstract] This device is designed for determining the rate of temperature change in thermophysical tests of materials by nonstationary methods. The unit works in conjunction with an F5080 chronometer-frequency meter and an F30 microvoltmeter. The device contains a tunable frequency divider that can be used independently and has a division coefficient that is set discretely by units from 0 to 999. Operation is based on linear conversion

of the emf code of thermocouples at the beginning and end of a set time interval to a number of electric pulses with subsequent readout of this number. The pulse difference compared with the frequency divider is displayed in digital form by the chronometer-frequency meter. Time intervals are digitally set by a timing relay in a range of 1-50 s by 0.1 s increments. The thermocouple emf varies from 0 to 50 mV. Error is ± 1 percent. The unit draws 60 W on 220 VAC, measures 600 x 200 x 400 mm and weighs 5.2 kg. A photograph is shown of the exterior of the device. Figures 1.

[71-6610]

6610

CSO: 1860

USSR

UDC 537.717.5.082.54

A METHOD OF MEASURING THE THICKNESS OF DIELECTRIC FILMS AND THE INDEX OF REFRACTION BY PHOTOELECTRIC SCANNING

Moscow VIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 249-251 manuscript received 2 Mar 78

SNEZHKO, YU. A.

[Abstract] A method is described for determining the thickness and index of refraction of transparent films on thick backings, and also for determining the thickness and index of refraction of transparent backings. The technique is based on measuring the phase distribution over the wave front of laser emission reflected from the object. The author explains the theoretical basis for determining thickness and index of refraction from measurements of the phase topography of the wavefront of reflected coherent radiation. A measurement facility based on the proposed technique is described. Measurements on polyorganosiloxane rubber films were done over a thickness range of $\sim 5\text{-}100 \mu\text{m}$ with accuracy of $\sim 2 \mu\text{m}$. The author thanks K. I. Krivosheev for assistance with the work. Figures 2; references 8 (Russian).

[71-6610]

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CSO: 1860

USSR

UDC 538.122.08

A GALVANOMAGNETIC THREE-COMPONENT MAGNETIC FIELD INDUCTION SENSOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 200-202
Manuscript received 26 Jun 78, after revision 12 Feb 79

DOLCIY, S. A., KUKUSHKIN, A. A., KULIKOV, YU. V., NIKOLAYEVSKIY, G. P.,
PARSHUTOV, V. T. and YATSUTA, M. I., Joint Institute of Nuclear Research,
Dubna

[Abstract] The conditions under which modern laboratory equipment is used require precise determination of the magnetic fields set up in the components of the equipment (magnetic channels for transporting charged particles, chamber and spectrometer magnets, superconducting dipoles and the like). The absolute value of the magnetic induction vector has to be known within 0.1 percent and the direction has to be known within 15'. The problem is most readily solved by using three Hall converters in mutually perpendicular planes. A three-component sensor with the converters combined in a single instrument gives the required accuracy and reduces measurement time by a factor of at least 3. The authors describe such a device with film Hall converters made of indium antimonide with an active surface of 0.7 x 4 mm accommodated on mutually perpendicular faces of a small metal cube. The assembled unit is enclosed in a thermostatically controlled housing held at 42 + 0.1°C. The distance between centers of the active surfaces is 4 mm. Using Hall converters to map a magnetic field with the required accuracy in three dimensions involves a planar effect of the converters. A method of calibration is described. Figures 3; references 5: 3 Russian, 2 Western.

[71-6610]

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CSO: 1860

USSR

UDC 620.179.13:631.3.029:71

AN OPTOELECTRONIC DEVICE FOR RECORDING HEAT PROFILES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 p 268
manuscript received 18 Aug 77

RAPOPORT, D. A., SHCHIPTSOV, V. S. and ISAYEVA, S. K.

[Abstract] This device is designed for measuring the temperature distribution on the surface of cylindrical and flat items, and can be used for thermal nondestructive inspection. It consists of a cylindrical horizontally scanning optical head, signal processing and recording modules. The optical head contains a flat scanning mirror and an objective mirror system that focuses the image on the modulation point, and also an output objective mirror system that focuses the image onto the receiver. The instantaneous angular field of view is 13', and the scanning field is 26°. Range to the object is 0.5-0.8 m, and the IR receiver is an InSb photoresistor cooled by liquid nitrogen. Data recording is on electrochemical paper or by pen chart-recorder. The temperature resolution is 0.2°C on a level of 30°C. The recording temperature range is 30-200°C. A photograph is shown of the exterior of the device. Figures 1.

[71-6610]

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CSO: 1860

UDC 621.317.361

A DIGITAL LOW-RANGE FREQUENCY METER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 156-159 manuscript received 12 Apr 78

INOZEMTSEV, YE. K. and BABAYEVA, O. S.

[Abstract] The proposed frequency meter uses series K155 logic elements. Logic operations convert the period of the input frequency to a binary pulse number, store this number, perform reverse conversion to an output frequency and measure the output frequency. The instrument can measure the instantaneous frequency of a waveform and its average value over two or four periods over a range of 0.5-2 Hz. This range can be extended in both directions by

simple modification of the circuit involving an increase in the number of digital places. Measurement time is 1-4 times the period of the input signal, and measurement error is 0.1 percent + 1 unit of the least significant digit. The device draws 15 W on 220 VAC, 50 Hz. Figures 3; references 1 (Russian).

[71-6610]

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CSO: 1860

USSR UDC 621.317.755.084

A WIDE-BAND STROBOSCOPIC INSTRUMENT FOR MEASURING INSTANTANEOUS SIGNAL VALUES FOR A CATHODE-RAY OSCILLOSCOPE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 154-156 manuscript received 24 Apr 78

VISHNEVSKIY, V. N., KUKHARENKO, N. A. and PETROVICH, A. G.

[Abstract] Conventional devices for measuring the instantaneous values of high-frequency signals are limited by a narrow frequency range (0-300 kHz). The use of stroboscopic converters to expand this passband involves the difficulty of noise suppression. The authors propose a technique for solving this problem by repeated strobing of the signal at a single point with accumulation of the results in digital form. The device enables measurement of the difference between instantaneous values at two points that are set by the operator using brightness marks on the screen of a cathode-ray oscilloscope. This instrument has a frequency range of 0-10 MHz, and signal amplitude range of 5-100 mV. Measurement error in these ranges is ≤ 1.5 percent. Set noise adjusted to the input is $\leq 500 \mu\text{V}$. Tests in a range of 0-50°C showed a 2 percent shift in conversion characteristics, which is readily accounted for by a calibrator built into the instrument. Figures 2; references 5: 4 Russian, 1 Western.

[71-6610]

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CSO: 1860

USSR

UDC 621.317.791:535.243

A DEVICE FOR AUTOMATIC PROCESSING AND REGISTRATION OF ATOMIC ABSORPTION SPECTROPHOTOMETER SIGNALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 p 266
manuscript received 4 Nov 77

BARON, V. YE., DMITRIYEV, D. I., KONONOVICH, V. I. and SOSENKO, V. A.

[Abstract] This unit is designed for operation with one-arm and two-arm spectrophotometers, and gives readings in percentage transmission and absorption of light, as well as in units of optical density and concentration. Optical density is measured by taking the logarithm of the intensity signals with simultaneous analog-digital conversion with a precision of 0.1 percent. A scaling unit converts readings from optical density units. Measurement accuracy is improved and the detection threshold is lowered by integration of input signals. Integration time can be set from 1 to 99 s with a 1 s step. The instrument finds and measures absorption peaks in processing signals of pulse analysis of atoms. In this case the period of discretization of input signals is 20 ms with 210 quantization levels. Input impedance is at least 0.5 megohm, and the range of input signal levels is 0-5 V. The unit draws no more than 150 VA and measures 350 x 350 x 450 mm. Mass is 12 kg. A photograph is shown of the exterior of the device. Figures 1.
[71-6610]

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CSO: 1860

USSR

UDC 621.317.795.2

MEASUREMENT OF TIME INTERVALS BY THE METHOD OF REGRESSING COINCIDENCES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 121-123 manuscript received 3 Apr 78

KARPOV, N. R., MATYUKHIN, YU. D. and POVARENIN, N. N., Ryazan Radio Engineering Institute

[Abstract] The paper describes a time measurement circuit based on the method of regressing coincidences. Operation starts with transmission of a square pulse to an OR gate with duration equal to the time interval to be measured. From the OR output the signal goes to the inputs of two delay

lines connected in parallel. The difference between the delays of the two lines sets the discreteness of the time measurement. The delayed pulses go to the input of an AND gate that produces a signal with duration shorter than the initial pulse by the amount of the discreteness. This pulse is recorded by a counter and goes to the second input of the OR gate. The cycle repeats until the duration of the time interval has been reduced to the discreteness step. The time interval is then determined from the number of cycles. If the discreteness step is taken as a multiple of the base of a system of notation (such as the decimal or binary number system), the display gives the numerical value of the measured time interval. A circuit is given showing application of the technique for measurement of time intervals in a range of 5-200 ns with discreteness of 1 ns in a temperature range from +20 to +60°C with measurement error of ≤ 2 ns. Figures 2; references 5 (Russian).

[71-6610]

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CSO: 1860

USSR

UDC 681.325.65:539.1.07

A DOUBLE-COINCIDENCE MATRIX

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 123-125 manuscript received 3 May 78, after revision 24 Oct 78

DEMENTIY, S. V., DENYAK, V. M., FARTUSHNYY, A. V. and OGURTSOV, V. I.

[Abstract] Coincidence matrices are used in multichannel counters for correlation experiments with registration of two or more particles. Such systems frequently utilize two coincidence gates, one of which measures the sum of true and random coincidences, while the other measures only random coincidences. However, such counters do not eliminate the error that is due to the lack of identity and the instability of the resolving times of the two gates. In order to eliminate this error the authors propose an event selection circuit that is based on the principle of dynamic equalizing of the resolving times of two coincidence gates. In this arrangement the gates act alternately in registration of both the sum of random and true coincidences and the random coincidences alone. In this way the influence of non-identity and instability of the resolving times of two gates is eliminated provided that the switching time is shorter than the time required for a change in

circuit parameters or in the conditions of registration. A block diagram of the event selection circuit is given, and a 4×6 double coincidence matrix based on these devices is described. Figures 2; references 4 (Russian). [71-6610]

6610
CSO: 1860

Oscillators, Modulators, Generators

USSR

UDC 621.373.42

NATURAL AND REDUNDANT FLUCTUATIONS IN HF TRANSISTORIZED SELF-EXCITED OSCILLATORS

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 958-968 submitted 19 Jul 78

BOGACHEV, V. M. and LYSENKO, V. G., Moscow Energy Institute

[Abstract] Increased requirements for purity of the radio signal spectrum in transistorized self-excited oscillators, transformers, and quasi-harmonic amplifiers make the problem of calculating fluctuations due to transistor noise extremely urgent. A stochastic differential equation with variable coefficients and a periodically transient right portion is solved precisely. Computer calculations of normed noise coefficients are used to calculate the energy spectra of transistor fluctuations in terms of the known equivalent circuit and selected operating conditions. Two examples of normed noise coefficients are considered for analysis of fluctuations in hf transistorized self-excited oscillators. Figures 1; tables 2; references 14: 12 Russian, 2 Western.

[42-8617]

8617

CSO: 1860

USSR

UDC 621.373.43

A SLOW SWEEP GENERATOR

Moscow Pribory i Tekhnika Eksperimenta in Russian No 5, Sep/Oct 79 pp 151-152 manuscript received 26 Oct 77

SHIRONOSOV, V. G., Izhevsk State Medical Institute

[Abstract] A generator that produces a slowly alternating voltage is needed for automatic recording of the temperature dependence of static susceptibility or for plotting the shape of the absorption line of magnetic resonance. Such a generator sets the control point in systems for controlling parameters such as temperature or magnetic field strength. The author describes such a generator based on a ShDR-721 stepper motor. Scanning time is continuously varied by changing the frequency of a multivibrator, and discretely varied by changing the number of flip-flops operating in the scaling mode. A

gearbox acts as an additional integrating link for increasing the number of steps per turn of a multiturn potentiometer. Scanning time can be regulated from 20 s to 17 hr with a total number of voltage steps equal to 12,000. Figures 2; references 1 (Russian).
[71-6610]

6610
CSO: 1860

USSR

UDC 621.373.5

A LOW-FREQUENCY QUARTZ-CONTROLLED OSCILLATOR BASED ON INTEGRATED CIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 150-151 manuscript received 13 May 77

KOROLEV, V. S. and MATIN, YE. N.

[Abstract] A stable quartz-controlled oscillator is described for a synchronous detection system. The circuit is a four-stage device. The first stage is the oscillator proper with the quartz crystal connected in a positive feedback circuit between the output and the noninverting input of an opamp. The second stage is a limiter amplifier with square-wave output on the fundamental frequency. The third stage is a frequency divider with output on half the fundamental frequency, and the last stage is another limiter amplifier. The quartz resonator is located in a passive thermostatic enclosure (a copper cylinder with 3 mm walls). The maximum amplitude of a 5 kHz output signal across a load of 1 k Ω is 10 V, and the corresponding level for a 2.5 kHz signal is 15 V. The oscillator draws 30 mA. Frequency drift is no more than $\pm 2 \cdot 10^{-5}$ over a temperature range of 0-60°C. Frequency variation is $\pm 2 \cdot 10^{-7}$ with 10% variation either way in the supply voltage. Frequency instability is $(1-2) \cdot 10^{-7}/\text{hour}$ with ambient temperature fluctuations of 2-3°C. The authors thank B. Sh. Ul'masbayev for constructive criticism. Figures 2; references 3: 2 Russian, 1 Western.

[71-6610]

6610
CSO: 1860

USSR

UDC 621.376.223

A SQUARE PULSE GENERATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 131-133 manuscript received 10 May 78

KOSHCHYEV, L. G.

[Abstract] A device based on a series circuit containing a thyristor pulse oscillator and a semiconductor diode is proposed for generating square pulses with duration of a few microseconds. Forward current flowing through the diode causes accumulation of an excess hole charge in the base. At the instant when reverse current begins to flow, provided that the load resistance is greater than the ratio between the voltage in the circuit and the reverse current, the accumulated charge density will be greater than the reverse current charge carrier density, and the voltage drop across the diode will be less than 1 V. The reverse voltage will be restored as there is a sharp drop in the reverse current through the diode within the time required for recovery of blocking properties. Experimental studies of a circuit based on this principle have shown the feasibility of producing 2 kV pulses with duration of 6 μ s, pulse power of 400 kVA and recurrence rate of 1.2 kHz. Figures 2; references 2 (Russian).

[71-6610]

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FREQUENCY FLUCTUATION OF BACKWARD WAVE OSCILLATORS OPERATING IN THE SHORT MILLIMETER WAVE RANGE

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 953-957 submitted 4 Jan 79

GORONINA, K. A., KUKIN, L. M. and LUBYAKO, L. V., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] Backward wave oscillators (BWO) are used as heterodynes in short-wave receivers operating in the millimeter range. The sensitivity of these receivers is severely limited by heterodyne noise. The method used in the paper to study frequency fluctuation is basically the same as the "delay line method." The function of the delay line is fulfilled by a superdimensional

waveguide Mach-Zender interferometer. To evaluate the contribution of thermal fluctuations in velocity, a model is employed in which the multi-velocity electron flux emitted by the cathode is replaced by one-velocity flux, and the magnitude of spectral density for random initial velocity is used. Figures 3; references 8: 6 Russian, 2 Western.
[42-8617]

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CSO: 1860

Pulse Techniques

USSR

UDC 621.374.34:621.382.2/.3

TRANSISTOR-DIODE PULSE SHAPERS THAT PRODUCE A VOLTAGE JUMP WITH TRANSITION TIME OF ABOUT 0.2 ns

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 137-139 manuscript received 3 May 78

PAVASARIS, CH. I. and ZHALKAUSKAS, V. I., Vil'nus State University

[Abstract] To deal with the problem of getting a stable picture of sub-nanosecond transient processes on an oscilloscope screen, transistor-diode pulse shapers have been developed that are triggered by the output synchro-pulse of an S7-11 stroboscopic oscilloscope. The output part of the equipment consists of a pulse shaper based on 2D524 diodes that are assembled in a standard 50-ohm coaxial line. The diodes operate in the charge accumulation mode and produce a voltage pulse with transition time of 0.1-0.15 ns. Another diode is used to clean up the step on the edge of the signal. If pulse shape is not a limiting factor, jumps with a transition time of <0.15 ns can be produced. Polarity can be either positive or negative, and the amplitude range of the jump is from 0.5 to 6 V. Figures 3; reference 1 (Russian).

[71-6610]

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PHASE AFC PULSE SYSTEM BASED ON MICROCIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 144-149 manuscript received 28 Jul 77

VASIL'YEV, V. P.

[Abstract] The block diagram and schematic are given for the phase AFC pulse system of a strobe pulse oscillator for precision servosystems. The algorithm of operation of the system is analyzed with the aid of a time diagram of signals at control points of the circuit. The circuit uses initial phasing, optimum correction of the oscillator tank, and storage of the frequency of the strobe pulse oscillator for reliable and exact synchronization when the input signal gating probability is less than 0.5. It takes no more than 0.15 s

for the system to pull in step. This phase AFC system uses commercially available integrated circuits. Figures 3; references 6: 5 Russian, 1 Western.

[71-6610]

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DUAL-RESONATOR CYCLOTRON RESONANCE MASER-OSCILLATOR WITH EXTERNAL FEEDBACK

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 1011-1019 submitted 3 May 78

YERGAKOV, V. S., MOISEYEV, M. A. and ERM, R. E., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] In CRM monoscopes, efficiency begins to drop, and then output, when electron beam current rises above some optimum magnitude. Conditions with high efficiency can be displaced towards higher current values by reducing resonator Q in order to achieve a high level of output. But resonator Q has a lower limit: reduction in Q_{\min} by reducing resonator length leads to a decrease in the non-isochronicity parameter (assuming constant electron beam voltage): this greatly diminishes efficiency. A dual-resonator CRM oscillator is more efficient than a CRM monoscope. A dual-resonator CRM oscillator can utilize shorter resonators with less Q; consequently, it can operate with greater current and output without significantly reducing efficiency. Controlled feedback makes it possible to widely vary CRM parameters and achieve better oscillation selectivity and high efficiency. Figures 6; references 5 (Russian).

[42-8617]

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CSO: 1860

Receivers and Transmitters

USSR

INTEGRATED RECEIVER

Moscow VESTNIK SVYAZI in Russian No 12, 1979 p 22

SIDOROVA, T. A., graduate student, Moscow Mining Institute and BAKHIREV, V. A., leading engineer

[Abstract] One of the efficient methods of enhancing noise immunity of digital signals which ensures maximum suppression of pulsed, fluctuating and spectrally focused interference is the method which makes it possible to evaluate the digital signals in terms of the average value in a bit. This method can be realized using a switched RC integrating filter with a time constant several times longer than the basic message. The method of integrated reception can be widely used in "noisy" communications lines, but it requires very accurate phase synchronization. An improperly established "zeroing" clock pulse phase greatly reduces the effect from reception of basic messages or generally leads to incorrect reception; thus another device is necessary to cut off the left and right message junctions of the message train. The proposed integrated receiver is not sensitive to a sequence of "ones" and "zeros" at the input, does not need phase synchronization in any of the cut-off nodes for each basic message block. The integrated receiver can be widely used for reception of information in "noisy" communications lines, especially in reception of elementary messages distorted by segmentation and pulsed interference in the communications channel. Figures 3.

[115-8617]

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CSO: 1860

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MAKING THIN SEMICONDUCTOR PLATES BY ELECTROLYTIC ETCHING

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 5, Sep/Oct 79 pp 262-263 manuscript received 18 Apr 78

SHENGUROV, V. G., SHABANOV, V. N., GUR'YANOV, A. G. and KOLOMIYETS, S. I., Gor'kiy Research Physicotechnical Institute of Gor'kiy State University

[Abstract] The authors describe a simple holder for epitaxial structures that obviates the need for gluing and ungluing specimens and subsequent degreasing of thin plates. The holder is a hollow fluorocarbon polymer cylinder with a rectangular port in one end for masking off the etching area. Close to the opening in the upper part of the holder is a platinum leaf spring in contact with a semiconductor plate. The epitaxial structure is located inside the cylinder with the backing toward the port. A nut applies pressure to a fluorocarbon polymer gasket that holds the specimen tightly against the port. The platinum leaf spring anode is insulated from the electrolyte by a fluorocarbon polymer sleeve. A threaded plug seals off the other open end of the cylinder. The cathode is a corrugated platinum plate placed horizontally beneath the vertical specimen. The process is monitored by a chart recording of the change in anode current. When the current drops to 5 percent of the initial value the circuit is automatically broken by a relay. The proposed etching technique produces thin layers of uniform thickness. Figure 1; references 5: 2 Russian, 3 Western.
[71-6610]

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CSO: 1860

USSR

UDC 621.396.67;621.372.8.092.22

STUDY OF THE DISPERSION OF ANISOTROPIC ARTIFICIAL DIELECTRICS

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 1002-1010 submitted 24 Jul 78

BORISOV, A. YU., BUBNOV, G. G. and SHAPIRO, R. V.

[Abstract] Anisotropic artificial media made on the basis of two-dimensionally and three-dimensionally periodic diffusing lattices (ellipsoids, spheres, disks, long and short cylinders, strips) are used for lens antennas, phase correctors, antenna caps and housings. Electrodynamic calculation of artificial structures reduces to a calculation of the equivalent coefficient of refraction and, in general, to a definition of equivalent values of tensor components of dielectric and magnetic permeance. New methods were developed because of the need to study the electrodynamic properties of lattice structures under conditions where the typical dimensions of lattice and diffuser parameters become commensurate with wave length; the considerable volume of calculations necessary, however, is a shortcoming. An electrodynamic method for studying the dispersion effects in anisotropic lattice structures is further developed. There exists resonance in some tensor components and the equivalent coefficient of refraction. The new theory quantifies and qualifies nascent resonance effects. Figures 4; references 10: 8 Russian, 2 Western.

[42-8617]

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CSO: 1860

Theory

USSR

UDC 538.56:519.25

STATISTICAL CHARACTERISTICS OF IMAGES PRODUCED IN OBSERVATIONS THROUGH AN UNEVEN INTERFACE OF MEDIA HAVING DIFFERENT REFRACTIVE INDEXES

Gorky IZV. VUZ: RADIOFIZIKA in Russian No 8, pp 989-1001 submitted 12 Jun 78

VEBER, V. L., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] Investigators are now intrigued by the theory and application of marine observation systems: many studies deal with the effect of the optical properties of the water on visibility in the hydrosphere. Using an approximate model, the multipoint statistical characteristics of the image of a self-illuminated object observed through the interface of media having different refractive indexes are defined. Concrete examples of calculation of correlation functions and energy spectra are cited for several sufficiently representative types of objects. Under conditions of intense distortion, the energy spectrum of image brightness is described by a two-dimensional Gaussian function in the neighborhood $k_x = \pm k_0$. The typical spectral width is completely defined by the parameter $\alpha = \epsilon k_0^2$, where $\epsilon = a^2 \sigma_p^2$, which in this case may be used as a characteristic of the relative width of the image spectrum of sinusoidal structure. The author deeply thanks L. S. Dolin for constant attention to the work. Figures 1; references 5 (Russian).
[42-8617]

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